# Section 2
# Substantive Draft EIR/EIS Revisions

The following sections provide a brief overview of the substantives changes and conclusions provided in the RDEIR/SDEIS. These changes in approach were made bothin the Draft EIR/EIS which appears in this RDEIR/SDEIS as Appendix A, *Revisions to the Draft EIR/EIS*; and they are also carried forward in the analysis for Alternatives 4A, 2D, and 5A (which appear in Section 4 of this RDEIR/SDEIS). Appendix A includes modified excerpts of text that originally appeared in the Draft EIR/EIS, with underlining showing new language and strikeout showingeliminated text. Appendix A does not include Draft EIR/EIS text that was not changed or that may be modified in the Final EIR/EIR in a non-substantive manner, and is focused primarilynon impact analysis revisions to Alternative 4, though other BDCP alternatives are addressed for some of the resources for various reasons. To give readers the best possible sense of the context in which such text changes occur, Appendix A includes section headings before and after modified passages, so that readers can understand precisely where within Draft EIR/EIS chapters the revisions occur.For a visual representation of how the document is laid out and how various segments relate to one another, please see the *Document Review Road Map* at the front of this document.

## 2.1 Fish and Aquatic Habitat Analyses

Draft EIR/EIS Chapter 11, *Aquatic Resources,* provided substantial information about the potential effects of the alternatives on fish and their habitats in the Plan Area and in upstream areas used by the evaluated species. Since release of the Draft EIR/EIS, the chapter has been revised to address design changes associated with the proposed project, to incorporate the latest engineering assumptions and modeling procedures, and to respond to comments raised by the public. Several comments requested elaboration on the methods used to arrive at CEQA conclusions and NEPA effects determinations and on the effects of contaminants. Additionally, commenters requested analyses of the effects on downstream bays (i.e., San Francisco Bay), and that all analyses include a NEPA conclusion. Since release of the Draft EIR/EIS, additional information has been developed pertaining to the following: the use of reusable tunnel material (RTM) for restoration efforts; the construction effects of the modification to Clifton Court Forebay; and the construction of an operable barrier at Head of Old River. This section briefly describesthe revisions and their effects on the impact analysis. These revisions serve to better articulate the analysis of effects, but do not change the level of significance or magnitude of the effects. Please refer to the references to review specific sections of the revised chapter.

### 2.1.1 Methods Used

Several commenters noted that the analytical approach for determining the effects on fish and aquatic resources of various operational aspects of the alternatives was difficult to understand. This was especially related to the presentation of impacts for certain fish species that relied on multiple modeling results as evidence for CEQA conclusions and NEPA effects determinations. To better explain the rationale and process applied to the development of the CEQA conclusions and NEPA effects determinations, the methods section has been updated (Chapter 11, *Fish and Aquatic Resources,* Section 11.3.2, in Appendix A) to more explicitly describe for each species life stage what methods were used and how the various modeling results were weighted. This approach was applied similarly for all alternatives. Additionally, information has been added to key impact analyses to articulate the biological linkages between changes in the physical environment and biological effects. Please refer to Chapter 11, *Fish and Aquatic Resources,* Section 11.3.2, in Appendix A.

### 2.1.2 Effects Downstream of the Plan Area

Chapter 11, *Fish and Aquatic Resources*, of the Draft EIR/EIS included a description of the potential changes in sediment loading as a result of the creation of new points of diversion under Alternatives 1A through 8. This analysis was used to inform the impacts related to turbidity (water clarity) for delta and longfin smelt. In summary, these impacts were deemed to be less than significant/not adverse because there would be less than a 10% change in sediment loading and because restoration actions could serve to increase turbidity in some areas. Additionally, as part of an environmental commitment in Appendix 3B, *Environmental Commitments*, in this RDEIR/SDEIS (similar to Avoidance and Minimization Measure [AMM] 6), sediments collected at the intake facilities and RTM excavated during construction activities could be reintroduced into the Delta at proposed restoration sites. (See in Appendix A of this RDEIR/SDEIS) Consequently, the overall effect in the Plan Area/Delta was determined to be only a minor degradation. Based on comments received from the public and additional study of the likely characteristics of RTM material, this environmental commitment and its parallel AMM have been revised to describe the anticipated feasibility of reuse of this material, as well as the applicable regulatory standards that any such material would be required to meet prior to its beneficial reuse. For text revisions to this commitment, please refer to Appendix A, *Draft EIR/EIS In-Text Chapter Revisions*, in this RDEIR/SDEIS, which includes an expanded and modified version of Draft EIR/EIS Appendix 3B, *Environmental Commitments*.

As part of this RDEIR/SDEIS, additional analyses have been conducted to take into account sea level rise, restoration sediment demand, and the effects of the creation of new points of diversion in order to better understand the magnitude of potential changes in sediment loading into the San Francisco Bay and other areas downstream of the Plan Area (generally the Delta, Suisun Marsh, and Yolo Bypass). A range of sediment demand from existing wetlands and restoration activities was combined with the sea level rise assumptions to understand the rate at which restored areas would act as sediment sinks in order to maintain elevation as sea levels rise. Relevant literature was used to determine the overall contribution of sediments fromthe Delta to the Bay, and a range of volumes of potential supplemental materials from both the diversion sediment collection process at the north Delta diversions and the RTM was developed based on current engineering estimates. This RDEIR/SDEIS includes an analysis of changes in sediment loading to the Bay for all of the alternatives, with specificity to operations-related effects and restoration-related effects.

In addition to the sediment analysis, further analysis was undertaken to assess the consequenes, if any, of the relatively minor changes in operations proposed across alternatives compared with the consequences already described in the Draft EIR/EIS. This new analysis evaluated the potential changes in water quality, salinity, flows, temperatures,and other factors potentially affecting fish habitat and behavior downstream of the Plan Area. The analyses indicted that these characteristics would be essentially unchanged, especially given the highly dynamic tidal environment of the Bay and its connection to the Delta. This analysis is included for Alternative 4A inSection 4.3.7, *Fish and Aquatic Resources*, for Alternative 2D in Section 4.4.7, for Alternative 5A in Section 4.5.7,and for the remainder of the alternatives in Chapter 11, *Fish and Aquatic Resources,* Section 11.3.5 in Appendix A of this RDEIR/SDEIS.

## 2.1.3 Selenium and Mercury

The analysis of selenium and mercury has been revised in three locations: revisions to Conservation Measure 12 *Methylmercury Management* and Avoidance and Minimization Measure 27 *Selenium Management* (see Appendix D); revisions to the CM4 tidal habitat contaminants analysis; and a new impact to specifically address effects of contaminants on fish as a result of change in operations (See Chapter 11, Impact AQUA-219 in Appendix A). Additional details on the mechanisms for mobilization of selenium and mercury into the food web and the potential for effects on aquatic resources have been added to the RDEIR/SDEIS, including details describing the uncertainties associated with the analytical methods. The conclusions regarding effects on water quality associated with BDCP water operations evaluated in Chapter 8, *Water Quality*, of the Draft EIR/EIS and the potential for effects on aquatic resources have been further evaluated, including details of the analytical methods, uncertainties and findings. This analysis is included as Impact AQUA219, applicable to all alternatives in Chapter 11, *Fish and Aquatic Resources,* Section 11.3.5 in Appendix A.

In response to reviewers' concerns that proposed restoration in Yolo Bypass could be a significant source of mercury methylation, a comparison of existing sediment and water quality data to the modeled conditions following proposed restoration activities has been included. To address the potential for selenium mobilization resulting from BDCP restoration actions, AMM27 has been expanded with specific requirements included to reduce the potential for bioaccumulation in covered fish species. Updated water quality data have been integrated into the selenium quantitative modeling for water and fish tissue under BDCP water operations, and results have been updated in Chapter 11, as shown in Chapter 11, *Fish and Aquatic Resources,* Section 11.3.5 in Appendix A.

## 2.1.4 NEPA Determinations

A small number of NEPA determinations were, at the time of the Draft EIR/EIS, determined to be "uncertain," or no determination was made. These effects were related to effects of the alternatives on salmonid fish migrations through the project area, effects of outflow on delta smelt and longfin smelt, and contaminant effects on all species. As described above, substantial effort has been put forth to better understand and articulate the potential for selenium and mercury effects on fish as a result of both operations and restoration actions proposed under the alternatives. This effort has allowed a more certain determination for contaminants effects under NEPA, which have been determined to be not adverse across all alternatives

- AQUA-8, Effects of contaminants associated with restoration measures on delta smelt
- AQUA-26, Effects of contaminants associated with restoration measures on longfin smelt
- AQUA-44, Effects of contaminants associated with restoration measures on Chinook salmon (winter-run ESU)
- AQUA-62, Effects of contaminants associated with restoration measures on Chinook salmon (spring-run ESU)
- AQUA-80, Effects of contaminants associated with restoration measures on Chinook salmon (fall-/late fall–run ESU)

- AQUA-98, Effects of contaminants associated with restoration measureson steelhead
- AQUA-116, Effects of contaminants associated with restoration measures on Sacramento splittail
- AQUA-134, Effects of contaminants associated with restoration measures on green sturgeon
- AQUA-152, Effects of contaminants associated with restoration measures on white sturgeon
- AQUA-170, Effects of contaminants associated with restoration measures on Pacific lamprey
- AQUA-188, Effects of contaminants associated with restoration measures on river lamprey
- AQUA-206, Effects of contaminants associated with restoration measures on non-covered aquatic species of primary management concern)

Regarding effects on salmonid migrations, uncertainty stemmed from contrasting model results for upstream flow conditions and effects of the north Delta diversion operations. Additional examination of modeling results, showing mixed conclusions for Alternative 4, indicates that it was modeling assumptions and not actual real-world changes in operations or criteria, that shifted the timing of releases from Lake Shasta, generating the mixed results for the upper Sacramento River. Additional coordination with NMFS and CDFW to develop the ability to make real-time adjustments to minimize effects on fish migrating past the intakes has resulted in greater confidence pertaining to migration effects. The analysis of Alternative 4A in Section 4.3.7, *Fish and Aquatic Resources*, Alternative 2D in Section 4.4.7 and Alternative 5A in Section 4.5.7 describe the analysis and determination of this effect, and the remainder of the alternatives are described in Chapter 11, *Fish and Aquatic Resources,* Section 11.3.5 in Appendix A.

### 2.1.5 Clifton Court Forebay Modification, Head of Old River Operable Barrier Construction, and Pile Driving Effects

The Draft EIR/EIS included relatively little discussion of the impacts on fish and aquatic resources from construction of the modified Clifton Court Forebay and the Head of Old River operable barrier under Alternatives 4. The main assumptions related to construction of these facilities were provided in Appendix 3C of the Draft EIR/EIS, and consideration and analysis of potential effects is provided in this RDEIR/SDEIS. The potential sources ofeffects on fish from these activities are similar to those discussed for construction of north Deltadiversions and barge landing sites: temporary increases in turbidity; accidental spills; disturbance of contaminated sediments; underwater noise; fish stranding; in-water work activities; loss of spawning, rearing, or migration habitat; and predation. The impacts from construction of the modified Clifton Court Forebay and the Head of Old River operable barrier would be rendered less than significant by application of appropriate AMMs and mitigation measures.

The effects of underwater noise caused by pile driving were reassessed to account for changes in the proposed construction approach as outlined in Appendix 3C, *Construction Assumptions*, of the Draft EIR/EIS. While the in-water work windows of July through October were maintained (see Tables 22B-1a through 22B-4d in Appendix 22B, *Air Quality Assumptions*, of the Draft EIR/EIS), the analysis was conducted assuming more concurrent pile-driving and without the use of attenuation structures. This analysis is included in Section 4.3.7, Fish and Aquatic Resources for Alternative 4A, Section 4.4.7 for Alternative 2D, Section 4.5.7 for Alternative 5A, and Chapter 11, *Fish and Aquatic Resources*, Sections 11.3.1.1 and 11.3.5, in Appendix A of the RDEIR/SDEIS for all other alternatives.

### 2.1.6 Non-Covered Fish Entrainment at the North Delta Diversion

The Draft EIR/EIS did not include a detailed analysis of the potential entrainment effects on non-covered aquatic species of primary management concern that have pelagic early life stages and therefore may be particularly susceptible to entrainment at the proposed north Delta diversions (i.e., egg and larval striped bass and American shad). An analysis has been included in this RDEIR/SDEIS to assess the potential for effects on these species because much of their spawning could occur upstream of the proposed north Delta intake locations, thus potentially subjecting eggs or larvae to entrainment. The analysis examines particle tracking model results from the Sacramento River upstream of the north Delta diversions. This impact analysis, and discussion of its relevance, is included in Chapter 11, Section 11.3.5, Impact AQUA-201, in Appendix A, and is applicable to all of the alternatives.

## 2.2 Water Quality Revisions

Chapter 8, *Water Quality*, of the Draft EIR/EIS evaluates effects on water quality from construction and operation of the proposed water conveyance facility (CM1) for Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9. Water quality impacts from other conservation measures (CM2–CM21) for these alternatives are evaluated at the programmatic level. Chapter 8 has been revised since release of the Draft EIR/EIS to address design changes associated with the proposed project, to include additional analysis, to make clarifications and correct errors, to update analyses based on more recent water quality data and/or criteria, and to respond to comments raised by local, state, and federal agencies and the public. Water quality constituent sections that received the most updating were electrical conductivity, chloride, selenium, bromide, and *Microcystis*. Additionally, an assessment of constituent effects downstream of the Plan Area (i.e., in San Francisco Bay) was added. Several other modifications and additions were made to the assessments for mercury, nutrients, trace metals, and dissolved oxygen. This section briefly describes the revisions to Chapter 8 and their effects on the impact analyses and impact determinations. Please refer to the document links to review specific sections of the revised chapter.

Additionally, three new alternatives – Alternative 2D, 4A, and 5A – were evaluated for effects on water quality from construction and operation of the water conveyance facility (CM1) and from other Environmental Commitments (CM 3, 4, 6, 7, 9–12, 15, and 16). The Alternatives evaluated in Chapter 8 discussed above contain many similarities to each other from a water quality perspective, and thus are often grouped together in the following discussion The three new alternatives are also very similar to each other, but from a water quality perspective, are fundamentally different than the Alternatives evaluated in Chapter 8 that are discussed above, in that they contain substantially less tidal restoration acreage. Although this section is focused on describing changes made in Chapter 8 from the Draft EIR/EIS, differences between the alternatives assessed in Chapter 8 and the three new alternatives are highlighted where appropriate.

## 2.2.1 Electrical Conductivity and Chloride

In the Draft EIR/EIS, all project alternatives (1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9) were found to have significant and unavoidable impacts on electrical conductivity and chloride in the Delta. These impacts were due in part to apparent exceedances of Bay Delta Water Quality Control Plan D-1641 water quality objectives shown in the modeling results at several locations under Existing Conditions, the No Action Alternative, and BDCP Alternatives. It was known that there are several factors related to the modeling approach that may result in modeling artifacts that show objective exceedance when, in reality, no such exceedance would occur. Appendix 8H Section 8H.1 of the Draft EIR/EIS described some of these factors, but the document did not include an evaluation of how many of these exceedances were thought to be a result of these factors and how many were expected to be actual project impacts. Furthermore, in the Draft EIR/EIS, mitigation measures for electrical conductivity and chloride called for additional modeling efforts to determine if impacts could be avoided or mitigated.

For chloride, most project alternatives evaluated in the Draft EIR/EIS were considered to have significant and unavoidable impacts in the Delta for the following reasons:

- modeling results showed exceedance of the 150 mg/L chloride objective,
- substantial increases in chloride were occurring in Suisun Marsh, and
- water quality degradation was occurring in the western Delta due to increased chloride concentrations.

For electrical conductivity, most alternatives evaluated in the Draft EIR/EIS were considered to have significant and unavoidable impacts for the following reasons:

- modeling results showed exceedance of the agricultural objective in the Sacramento River at Emmaton,
- modeling results showed exceedance of the agricultural objective in the San Joaquin River at San Andreas Landing,
- modeling results showed exceedance of the fish and wildlife objective between Prisoners Point and Jersey Point,
- modeling results showed exceedance of the agricultural objective in Old River at Tracy Bridge,
- substantial increases in EC were occurring in Suisun Marsh, and
- water quality degradation was occurring in the western Delta due to increased EC.

To address some of these issues, since publication of the Draft EIR/EIS, the Lead Agencies conducted sensitivity analyses and other analyses to evaluate whether exceedances were modeling artifacts (and thus would not occur) or were potential project-related impacts (which could occur). These included modeling runs investigating the impact of the following:

- Changing the existing Emmaton electrical conductivity compliance location to a new location at Threemile Slough, as proposed in the version of the BDCP circulated with the Draft EIR/EIS
- Monthly-daily patterning at the Delta boundary locations (see Section 8.3.1.1 in Appendix A for a description of monthly-daily patterning), including the Suisun Marsh Salinity Control Gates, under the alternatives.

- Removing tidal restoration areas (i.e., assuming no tidal restoration, as opposed to the tidal restoration areas that were previously assumed under Alternative 4 at the late long-term) as a means of understanding the contribution of restoration vs. CM1 to exceedances.
- Revising Head of Old River Barrier operations during April and May.

Additionally, evaluation of individual exceedances was conducted in some cases to determine whether modeling time step and averaging, model imprecision, or imperfections in the Artificial Neural Network played a role in each exceedance shown by the modeling.

The findings and outcomes of the sensitivity analyses were the following.

- Regarding exceedances of the Sacramento River at Emmaton EC objective for protection of agricultural beneficial uses (which is a maximum 14-day running average of mean daily EC and applies April 1 through August 15, but varies in the specific numeric threshold by water year type and season), assuming the electrical conductivity compliance location at Emmaton instead of Threemile Slough greatly decreased exceedances of this objective at Emmaton to levels similar to those occurring under the No Action Alternative. Based on this finding, the project description for Alternative 4 was modified to remove the change in compliance point for the Emmaton electrical conductivity objective. Previously, the project descriptions for all action alternatives included a change in compliance point from Emmaton to Threemile Slough. The revised version of Alternative 4 would maintain, and not propose to change, the existing compliance point at Emmaton, while all other alternatives assessed in the Draft EIR/EIS (1A, 1B, 1C, 2A, 2B, 2C, 3, 5, 6A, 6B, 6C, 7, 8, and 9) still include the proposed change to Threemile Slough. With this change, Alternative 4 no longer shows a significant impact with respect to the Bay-Delta WQCP EC objective exceedance at Emmaton, while all other alternatives assessed in the Draft EIR/EIS (1A, 1B, 1C, 2A, 2B, 2C, 3, 5, 6A, 6B, 6C, 7, 8, and 9) still show significant impacts due to EC objective exceedance at Emmaton. The three new Alternatives assessed in this RDEIR/SDEIS (4A, 2D, 5A) also maintain the existing compliance point at Emmaton, and thus, for the reasons discussed above, do not show significant impacts due to EC objective exceedance at Emmaton.
- Regarding exceedances of the San Joaquin River at San Andreas Landing EC objective for protection of agricultural beneficial uses (which is a maximum 14-day running average of mean daily EC and applies April 1 through August 15, but varies in the specific numeric threshold by water year type and season), some of the modeled exceedances were found to be modeling artifacts due to monthly-daily patterning effects (see Section 8.3.1.1 in Appendix A for a description of monthly-daily patterning), and the small number of remaining exceedances were small in magnitude, lasted only a few days, and could be avoided or otherwise satisfactorily addressed with real time operations of the SWP and CVP (see Chapter 8, Section 8.3.1.1 in Appendix A for a description of real time operations of the SWP and CVP). Based on these findings, all project alternatives (those assessed in the Draft EIR/EIS, as well as the new alternatives) no longer show significant impacts with respect to EC objective exceedance at San Andreas Landing.
- Regarding exceedances of the San Joaquin River between Prisoners Point and Jersey Point EC objective (which is a maximum 14-day running average of mean daily EC of 0.44 mmhos/cm and applies April through May of all but critical water years), removing tidal restoration areas (i.e., assuming no tidal restoration, as opposed to the tidal restoration areas that were previously assumed under Alternative 4 at the late long-term) reduced the number of exceedances, but

there were still substantially more exceedances than under Existing Conditions or the No Action Alternative. Results of the sensitivity analyses indicate that the exceedances are partially a function of the operations of the alternative itself, perhaps due to Head of Old River Barrier assumptions and south Delta export differences. Appendix 8H Attachment 2 was added, which contains a more detailed assessment of the likelihood of these exceedances impacting aquatic life beneficial uses. Specifically, Appendix 8H Attachment 2 discusses whether these exceedances might have indirect effects on striped bass spawning in the Delta, and concludes that the high level of uncertainty precludes making a definitive determination. Thus, although uncertain, significant impacts on EC remain relative to this objective for Alternatives 2, 4, 6, 7, and 8. The physical effects and beneficial use at issue here relate to how suitable this stretch of the San Joaquin River is for spawning of striped bass, a nonnative species that preys on the Delta smelt. No such significant effects occur for Alternatives 1, 3, 5, and 9. Alternative 2D and 4A are expected to result in fewer and lower magnitude exceedances of this objective due to the lower acreage of tidal restoration, but to ensure that the objective is met, mitigation measures were introduced that would adaptively manage the split between North and South Delta intake diversions and Head of Old River Barrier operations With the introduction of this mitigation measure, Alternatives 2D, 4A, and 5A do not show significant impacts with respect to EC objective exceedances at Prisoners Point.

- Regarding exceedances of the Old River at Tracy Bridge EC objective for the protection of agricultural beneficial uses (which is a maximum 30-day running average of mean daily EC of 0.7 mmhos/cm April through August and 1.0 mmhos/cm September through March), some of these exceedances were found to be modeling artifacts due to monthly-daily patterning effects (see Section 8.3.1.1 in Appendix A for a description of monthly-daily patterning), and the remaining exceedances could be resolved by assuming the continuation of historical dry year practices of installing barriers earlier in the year. Thus, no significant (CEQA) or adverse (NEPA) effects would occur. Furthermore, as noted in Chapter 8, Section 8.1.3.7 of Appendix A, SWP and CVP operations have relatively little influence on salinity levels at these locations, and the elevated salinity in south Delta channels is affected substantially by local salt contributions discharged into the San Joaquin River downstream of Vernalis.

- Modeling of all alternatives assumed no operation of the Suisun Marsh Salinity Control Gates, but the project description for all alternatives now assumes continued operation of the Salinity Control Gates, consistent with assumptions included in the No Action Alternative. A sensitivity analysis with the gates operational consistent with the No Action Alternative resulted in substantially lower EC levels in Suisun Marsh than indicated in the original modeling results, but EC levels were still somewhat higher there than EC levels under Existing Conditions and the No Action Alternative for several locations in the Marsh and for several months. Another modeling run with the gates operational and restoration areas removed resulted in EC levels nearly equivalent to those found in Existing Conditions and the No Action Alternative, indicating that design and siting of restoration areas has notable bearing on EC levels at different locations within Suisun Marsh. These analyses also indicate that increases in EC levels shown in the modeling conducted for the Draft EIR/EIS were related primarily to the hydrodynamic effects of CM4 under the alternatives assessed (1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9) not operational components of CM1. Based on the sensitivity analyses, optimizing the design and siting of restoration areas for these alternatives consistent with proposed environmental commitments, avoidance and minimization measures, and mitigation measures is expected to be able to reduce EC increases, relative to Existing Conditions and the No Action Alternative, to levels that would be less than significant. Mitigation Measure WQ-11d discusses these actions.

All of the same applies to chloride levels in Suisun Marsh, and Mitigation Measure WQ7d discusses these actions. The new alternatives 2D, 4A, and 5A, contain much lower acreage of tidal restoration, and thus are anticipated to not have significant impacts with respect to EC and chloride in Suisun Marsh.

The assessment of exceedances of the Bay Delta WQCP 150 mg/L chloride objective in the Draft EIR/EIS was also revised based on discovery of errors made in the original analysis. The Bay-Delta WQCP contains a chloride objective for Contra Costa Canal at pumping plant #1 or the San Joaquin River at Antioch Water Works intake that specifies the number of days each calendar year that the maximum mean daily chloride concentration must be less than 150 mg/L (must be provided in intervals of not less than 2 weeks' duration). The days per year depend on water-year type, ranging from 155 days for critical water-year types to 240 days in wet water-year types. In the original analysis, the predicted exceedances of this objective were based on the number of days in a calendar year that chloride is below certain specified limits at these locations. The DSM2 water quality model projects future conditions based in part on a representative recent 16-year time period reflecting varying hydrological conditions in California (i.e., water years 1976-1991). DSM2 was run for 16 *water* years (water years 1976–1991, i.e., October 1, 1975 – September 30, 1991), which only includes 15 complete *calendar* years (1976–1990). The final calendar year of the DSM2 simulation, 1991, was inadvertently included in the compliance assessment, even though modeling for 1991 did not include the whole calendar year, but stopped at the end of water year 1991 (i.e., September 30). This resulted in reporting of exceedances of the objective for calendar year 1991, when in fact the modeling results do not exist to determine if the objective was exceeded. Specifically, starting at the beginning of the calendar year, the compliance assessment algorithm keeps a running total of the number of days that meet the water quality criterion, then reports the total number of days in that year that met the criterion, and that number of days is compared to the required number of days from the water quality objective. Since modeling ended September 30, 1991, the last year only had 273 days available for counting, instead of the full 365. The minimum required number of days was usually not achieved for this year, so it was denoted as an exceedance of the objective. However, had the full 365 days been available, compliance with the objective may have occurred—the modeling results do not exist to determine this issue. The assessment was revised to remove calendar year 1991, so assessment was based on calendar years 1976-1990 of the original modeled results (i.e., 15 years instead of 16), and the impact conclusions were updated accordingly. Correcting of this error resulted in a more accurate assessment, and resulted in fewer exceedances of the objective under the project alternatives assessed in the Draft EIR/EIS (1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9) than previously indicated. The specific number of exceedances predicted under the revised approach varied by alternative, and for some alternatives remained a significant impact. The new alternatives 2D, 4A, and 5A, did not contain any exceedances of this objective, likely in part due to the lower acreage of tidal restoration included in these alternatives.

Another issue that was resolved involved application of the correct water quality objectives based on the water year type appropriate to the modeled time step. As discussed above, the Draft EIR/EIS contained an assessment of compliance with Bay Delta Water Quality Control Plan electrical conductivity and chloride water quality objectives based on outputs from the DSM2 model. The modelling projects future conditions based in part on a representative recent 16-year time period reflecting varying hydrological conditions in California (i.e., water years 1976-1991). Some of the Water Quality Control Plan objectives are dependent on water year type (e.g., wet or dry). The water year type is a designation used to denote the water supply or water availability for a given water year, and is based on a formula that includes estimates of the unimpaired runoff in the Sacramento

River watershed. For each water year of the DSM2 simulation used (water years 1976–1991), the water year type that was used to define the objective was the water year type that was assigned under Existing Conditions hydrologic conditions. However, climate change assumptions alter the timing and magnitude of unimpaired runoff estimates, which alter the water year types assigned to the years in the DSM2 simulation. Because of this, 3 of the 16 water years in the simulation change their type in the late long term as a result of climate change. Thus, for the late long term scenarios, compliance should have been based on the objective defined according to the late long term water year types, not the Existing Conditions water year types. This change was made and the compliance assessment tables were updated. In general, this change resulted in the modeled predicted percent of days out of compliance increasing by 0–5% in both the No Action and the project alternatives, depending on the alternative and water quality objective evaluated. However, these changes did not fundamentally alter any of the impact conclusions at these sites.

Finally, understanding the uncertainties and limitations in the modeling and assessment approach is important for interpreting the results and effects analysis, including assessment of compliance with water quality objectives. Please refer to Chapter 8, Section 8.3.1.1, *Models Used and Their Linkages*, and Section 8.3.1.3, *Plan Area*, in Appendix A for a description of these limitations. In light of these limitations, the assessment of compliance was conducted in terms of assessing the overall direction and degree to which Delta EC or chloride would be affected relative to a baseline, and discussion of compliance did not imply that the alternative would literally cause Delta chloride to be out of compliance a certain period of time. In other words, the model results are to be used in a comparative mode, not a predictive mode. Furthermore, in reality, staff from DWR and Reclamation constantly monitor Delta water quality conditions and adjust operations of the SWP and CVP in real time as necessary to meet water quality objectives. These decisions take into account real-time conditions and are able to account for many factors that even the best available models cannot simulate. Thus, it is likely that some objective exceedances simulated in the modeling would not occur under the real-time monitoring and operational paradigm that will be in place to prevent such exceedances.

Based on the findings of all of the analyses discussed above, results of the electrical conductivity and chloride assessments were qualified, and the impact determinations were revisited. Additionally, because these efforts shed light on why certain exceedances were occurring, it was possible to revise mitigation measures to better address the causes of the exceedances. All alternatives assessed in the Draft EIR/EIS (1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9) remained significant and unavoidable for chloride and EC, but the reasons are now only the following:

- Exceedance of water quality objectives for EC in the Sacramento River at Emmaton (Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 5, 6A, 6B, 6C, 7, 8, and 9 – but not Alternative 4)
- Water quality degradation in the western Delta due to increased chloride concentrations and EC (Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9), and
- Exceedances of the fish and wildlife EC objective between Prisoners Point and Jersey Point (Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9).

Thus, although the impacts remain significant and unavoidable, the magnitude of the impacts is substantially less than was indicated in the Draft EIR/EIS.

Alternatives 2D, 4A, and 5A did not contain significant impacts for EC related to objective exceedance in the Sacramento River at Emmaton, did not contain substantial degradation in the western Delta due to increased chloride concentrations, had less water quality effects in the western

Delta related to EC, and fewer exceedances of the fish and wildlife EC objective between Prisoners Point and Jersey Point, such that it was feasible to introduce mitigation that would prevent significant impacts related to EC increases. After introduction of these mitigation measures, Alternatives 2D, 4A, and 5A contained less than significant impacts for EC. Alternatives 2D, 4A, and 5A contained less than significant impacts for chloride as well.

Refer to Chapter 8, *Water Quality*, Sections 8.1.3.4 and 8.3.1.7 in Appendix A for a discussion of historical compliance with chloride and electrical conductivity objectives, respectively. Refer to Chapter 8, *Water Quality*, Section 8.3.1.7 (*Chloride* and *Electrical Conductivity* subsections) in Appendix A for a discussion of the change in water year types at different time steps and sensitivity analyses performed. Refer to Mitigation Measures WQ-7 and WQ-11 in Sections 8.3.3.1 through 8.3.3.16 in Appendix A for the assessment and mitigation measures, which have been updated to account for water year type changes, sensitivity analyses performed, additional context, and corrections to the chloride 150 mg/L objective assessment; and to Appendix 8G and 8H in Appendix A for updated information supporting changes to the assessment. Refer to Section 4 and associated material in Appendix B for the assessment of Water Quality for Alternatives 4A, 2D and 5A.

### 2.2.2 Selenium

Modeling for selenium (water concentrations and bioaccumulation modeling) was updated on the basis of a review and update of Delta source water concentrations of selenium. Public comments on the Draft EIR/EIS indicated that the source water concentrations for both the Sacramento River and San Joaquin River were likely biased high (i.e., the modeling approach used concentrations for both rivers that indicated more selenium than is currently actually present in the rivers). This bias was due to inclusion of older monitoring data that used higher detection limits (on both rivers), as well as to the decrease of selenium concentrations on the San Joaquin River that has occurred over time. The source water concentrations for the Sacramento River, San Joaquin River, Yolo Bypass, and San Francisco Bay were reevaluated and re-derived using the most recent data available, and the water concentration and bioaccumulation modeling was updated based on these updated source water concentrations. Results showed that there was generally a greater increase from Existing Conditions and No Action concentrations to the concentrations under the alternatives than previously predicted (i.e., the relative effect of the project was greater) However, the absolute values of all of the estimated concentrations for Existing Conditions, the No Action Alternative, and all Project Alternatives were lower than modeled previously in the Draft EIR/EIS, and thus were lower relative to thresholds of concern and water quality criteria used in the assessment.

The bioaccumulation modeling methodology for bass in the Delta was also updated. Bioaccumulation modeling is dependent on the choice of $K_d$, the ratio of selenium concentration in particulates vs. water. The higher the value of $K_d$, the greater the bioaccumulation of selenium. Previously, the choice of $K_d$ was "static" for both bass and sturgeon, and did not vary by location or concentration of selenium in the water. The model was updated for bass based on more recent understanding that $K_d$ tends to be higher at lower water concentrations than at higher concentrations. The result of this change is that predicted bass tissue concentrations in the Delta are more consistent across location and Alternative than was determined in the Draft EIR/EIS. This update could not be made for sturgeon bioaccumulation modeling because there was insufficient monitoring data with which that model could be calibrated for such a change.

Numeric thresholds used in the selenium assessment were also updated. Current ambient water quality criteria are based on waterborne selenium concentrations, but EPA released draft water quality criteria for the protection of freshwater aquatic life from toxic effects of selenium in May 2014. The draft criteria include tissue-based concentrations, which are most closely associated with reproductive effects. The criteria also include water concentrations, which are to be used when fish tissue data is not available. The draft criteria have not been finalized, but they represent the most current science on numeric thresholds protective of beneficial uses. Accordingly, these draft criteria were used in the updated assessment. Specifically, the whole-body fish tissue threshold was lowered from 9 mg/kg to 8.1 mg/kg. Additionally, the criterion against which water concentration changes were compared was lowered from 2 μg/L to 1.3 μg/L, which is the EPA draft criterion for lentic (i.e., still or slow-moving) water bodies.

An expanded discussion of residence time in the Delta and its effect on selenium bioaccumulation in the Delta was added in response to agency comments. Increased water residence times could increase the bioaccumulation of selenium in biota, thereby potentially increasing fish tissue and bird egg concentrations of selenium. However, if increases in fish tissue or bird egg selenium were to occur due to residence time changes alone, the increases would likely be of concern only where fish tissues or bird eggs are already elevated in selenium to near or above thresholds of concern. That is, where biota concentrations are currently low and not approaching thresholds of concern, changes in residence time alone would not be expected to cause them to then approach or exceed thresholds of concern. Based on the analysis, the most likely area in which biota tissues would be at levels high enough that additional bioaccumulation due to increased residence time from restoration areas would be a concern is the western Delta and Suisun Bay for sturgeon. Nevertheless, estimates of residence time increases in these areas are small enough that they are not expected to substantially affect selenium bioaccumulation in the western Delta.

The changes discussed above did not result in any changes to the impact conclusions. Alternatives 6–9 remain adverse (under NEPA) and significant and unavoidable (under CEQA) due to modeled substantial increases in fish tissue concentrations for sturgeon in the western Delta, while Alternatives 1–5 remain less than significant.

Refer to Chapter 8, *Water Quality*, Section 8.1.3.15 in Appendix A for updated existing selenium concentrations in the affected environment and a description of the EPA draft criteria. Refer to Section 8.3.1.7 in Appendix A for the updated source water concentrations used in the modeling and updated thresholds used in the assessment. Refer to Impact WQ25 in Sections 8.3.3.1 through 8.3.3.16 in Appendix A for the selenium assessment updated based on the new modeling. Further details on the updates can be found in Appendix 8M, *Selenium*, in Appendix A.

## 2.2.3 Bromide

Additional description was added to describe more fully the CALFED bromide goal used in the assessment. Specifically, the additions describe the background behind derivation of the EPA bromate maximum contaminant level (MCL), its relevance to the CALFED numeric bromide goals, and the non-numeric portion of the CALFED goal regarding an equivalent level of public health protection using a cost-effective combination of alternative source waters, source control, and treatment technologies.

Additional descriptions regarding modeling uncertainty and assumptions were also added. Specifically, these address assumptions regarding sea level rise and the assumed footprint and design of restoration areas, and the performance and accuracy of DSM2 in the Barker Slough area.

Sensitivity analyses were conducted to evaluate what factors were causing or contributing to bromide increases in Barker Slough. Findings from these analyses were incorporated into the assessment, and mitigation measures were revised to better address the factors contributing to the increases. With regard to bromide, all alternatives assessed in the Draft EIR/EIS (1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9) remain adverse (under NEPA) and significant and unavoidable (under CEQA). However, it is now known that the cause of the modeled increases in bromide in Barker Slough, which was driving the impact determinations for almost all alternatives, is assumptions regarding CM4 implementation, not operations in CM1. Thus the mitigation measure was revised to more appropriately address actions that could lessen the projected impact, based on these findings.

Because the new alternatives (2D, 4A, and 5A) contain a lower acreage of tidal restoration, significant impacts with regards to bromide are not expected under these alternatives.

Refer to Chapter 8, *Water Quality*, Section 8.1.3.3, 8.3.1.7, and Impact WQ-5 in Sections 8.3.3.1 through 8.3.3.16 in Appendix A for the bromide additions and revisions.

### 2.2.4 Mercury

Modeling results and findings for Impact WQ-13 under Alternative 8 were revised and updated. Specifically, results for water column and fish tissue methylmercury under Alternative 8 contained in the Draft EIR/EIS were inadvertently based on erroneous source water concentrations for methylmercury; accordingly, these were corrected and the modeling rerun. These corrections lowered the concentrations predicted under Alternative 8, but did not change the assessment conclusions. Alternative 8 previously contained an adverse (under NEPA) and significant and unavoidable impact (under CEQA) on mercury and methylmercury, and while the magnitude of the impact is now lower, it remains adverse and significant and unavoidable due to substantial increases in modeled methylmercury concentrations in multiple locations throughout the Delta.

Additional information regarding the uncertainty inherent in the mercury bioaccumulation modeling approach was added to Appendix 8I of Appendix A and referenced in the assessment. This information is important when interpreting smaller increases or decreases in fish tissue mercury levels that were estimated via the models. Refer to Chapter 8, *Water Quality*, Section 8.3.3.15, Impact WQ-13 in Appendix A for the updated Alternative 8 mercury assessment. Refer to Appendix 8I of Appendix A for the discussion of model uncertainty.

The three new alternatives – Alternative 2D, 4A, and 5A – differed from the alternatives assessed in the Draft EIR/EIS (1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9) in their evaluation of effects on mercury from other environmental commitments (CM 3, 4, 6, 7, 9–12, 15, and 16). The three new alternatives contain substantially less tidal restoration acreage than those in the Draft EIR/EIS. Thus, although the potential types of effects on mercury resulting from implementation of the environmental commitments under the new alternatives would be generally similar to those described for alternatives assessed in the Draft EIR/EIS, the magnitude of effects on mercury and methylmercury at locations in the Delta related to habitat restoration would be considerably lower.

It is not expected that the level of tidal restoration proposed under Alternatives 2D, 4A, and 5A would cause fish tissue concentrations to increase, at a measurable level, outside of the immediate localized area of the tidal restoration sites. However, habitat restoration has the potential to increase water residence times and increase accumulation of organic sediments that are known to enhance methylmercury bioaccumulation in biota in the vicinity of the restored habitat areas. Fish tissue concentrations in the Delta already frequently exceed the Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins objective of 0.24 mg/kg for trophic level 4 fish in the Delta. The proposed tidal restoration may cause or contribute to increased fish tissue concentrations at a local level, though the magnitude of the increase is not quantifiable. The Basin Plan also includes methylmercury allocations for wetlands for various areas of the Delta. Because the proposed tidal restoration acreage is verysmall, it is possible that, relative to the allocations, the increased loading would be very small. However, it is still unknown how and if the allocations can be attained. The Basin Plan also requires that for many areas of the Delta (i.e., those needing reductions in methylmercury), proponents of wetland restoration projects shall (a) participate in Control Studies, or implement site-specific study plans, that evaluate practices to minimize methylmercury discharges, and (b) implement methylmercury controls as feasible. Design of restoration sites would be guided by Environmental Commitment 12, which requires development of site-specific mercury management plans as restoration actions are implemented to minimize methylmercury production. The effectiveness of minimization and mitigation actions implemented according to the mercury management plans is not known at this time, although the potential to reduce methylmercury concentrations exists based on current research.

Although this would constitute a potential environmental impact, these increases would not be expected to cause injury to downstream water rights holdersor other downstream water users, because effects would be localized to the restoration sites. Nor would such localized impacts adversely affect any other downstream beneficial users.

## 2.2.5 Microcystis

Assessment of the effects of the project on *Microcystis aeruginosa*, a nuisance and toxic cyanobacteria species, was added to the chapter. This section was added in response to public comments, as well as in recognition of the existing threat to water quality that *Microcystis* poses. In part because it is not technically a water quality constituent, andin part due to the lack of state or federal water quality standards, *Microcystis* did not appear in the screening analysis that was performed (Appendix 8C). Due to the combined effects of increased temperatures due to climate change (not related to the project) and increased residence times in the Delta (due primarily to the project related effects of CM1 and CM4), effects ofproject alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9 on Microcystis were considered adverse (under NEPA) and significant and unavoidable (under CEQA). Mitigation measure WQ-32 was created to attempt to lessen the effects of the alternatives on Microcystis.

Because the new alternatives (2D, 4A, and 5A) contain a lower acreage of tidal restoration, residence times are not expected to increase as substantially as under the other alternatives, and thus significant impacts with regards to *Microcystis* are not expected under these alternatives, relative to the No Action Alternative.

Refer to Chapter 8, *Water Quality*, Section 8.1.3.18 for a description of the existing conditions regarding Microcystis, Section 8.3.1.7 for methodological considerations used in the assessment, and Impacts WQ-33 and WQ-34 in Appendix A for the Microcystis assessment.